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A Doubly Curved Element for Laminated Composite Shells Undergoing Finite Rotation

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A finite element formulation via tensor notation for geometrically exact nonlinear laminated composite shells is presented. The present 5/6-DOF shell theory is based on total Lagrangian concept where the Green-Lagrange's strain tensor and and the work conjugate 2-nd Piola-Kirchoff stress tensor plays the central role. The two parametric incremental material rotation vector is considered to be orthogonal to the shell director. To improve the performance of the present 4/9-noded element, EAS scheme combined with ANS scheme is employed. The update procedure of the nodal rotation is kept additive within a load increment step. To avoid the singularity problem the load increment size is restricted to render the rotation magnitude less than π. The performance of the element is found to be exciting in linear and nonlinear regime for a wide class of structural problems. New results are presented for different structural problems under thermo-mechanical loads.

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